PFRP

Pelagic Fisheries Research Program

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Trends in NE Atlantic and Mediterranean Bluefin Abundance

Christelle Ravier, Jean-Marc Fromentin

Historical Catches from Trap Fisheries

For ages, fishermen benefited from the seasonal migrations of bluefin in the Mediterranean by setting traps along its routes (Doumenge, 1998). The traps were fixed, passive tools (see Figure 1) that were only slightly modified over the centuries. Used since the Middle Ages, they belonged to aristocrats and bankers, who kept detailed accounts of their catches over several centuries.

We carried out an intensive search through national and naval archives, scientific libraries, and various Mediterranean laboratories to collect historical records about the traps. The pertinent information was retrieved from diverse sources, including:

- ancient books published by local authorities or clergy (e.g., Padre Sarmiento, 1757);
- books devoted to historical analysis (e.g., Cancila, 1972);
- owners' archives (e.g. Duchy of Medina Sidonia); or,
- personal archives accumulated by passionate, relentless scientists (e.g. Sella, Scaccini, and Rodriguez-Roda; for more details on data collection, see Ravier and Fromentin, in press).

We gathered more than 100 time series of catch records, but only the 54 that were at least 20 years long were retained for analysis. The oldest time series dated to the early17th century in Sicily, while others dated to the 18th century in Portugal, the19th century in Sardinia and Tunisia, and the 20th century in Spain and Morocco (see Figure 2). About a third of the time series were more than 50 years long, and 6 provided catch records for more than a century.

Short- and Long-term Variations

Fluctuations in trap catches appear to be of large magnitude, with periods during which the large catches were as much as 10 times greater than the small catches. This temporal variability may be broken down into three main periods: pseudo-cyclic fluctuations of 100 to 120 years, cycles of 15 to 30 years with a peak around 20 years, and year-to-year fluctuations. The middle- to long-term trends accounted for 45% to 80% of the total variability in catch volume (Figure 2), which has been rarely documented

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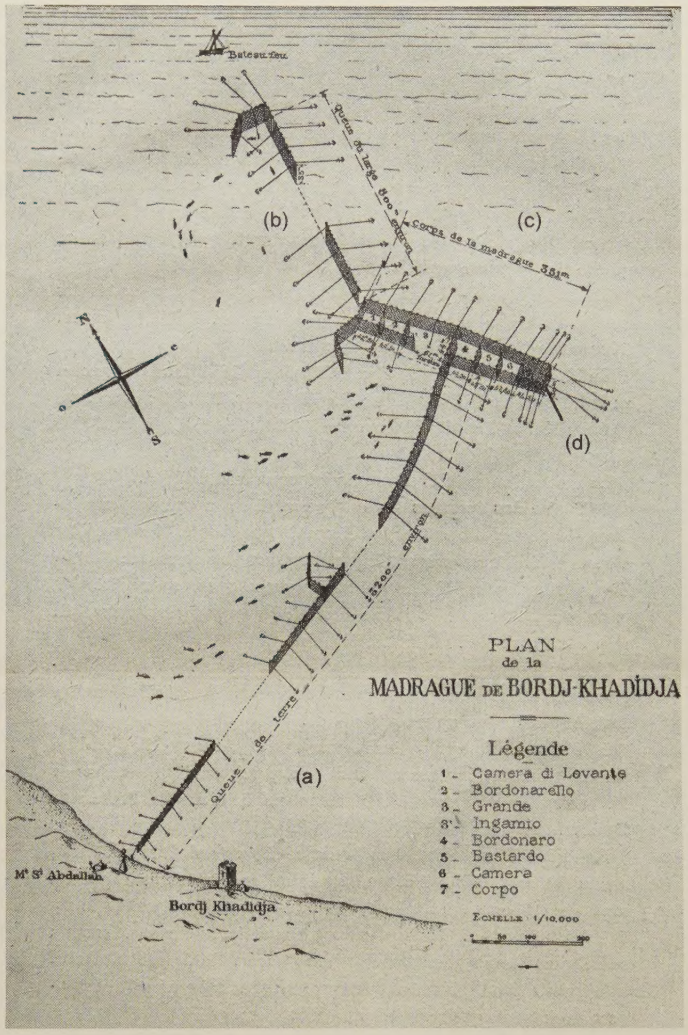

Figure 1. The Tunisian trap of "Bordj Khadidja," from Parona, circa 1919. Tunas, hugging the coast in their spawning migration, were guided by the two net barriers (a, b) up to the body of the trap (c). There they passed through several "rooms" up to the final compartment, the "death room" (d), where the net floor could be lifted. Tunas were gaffed here by fishermen and brought on board Khadidja's boat.

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Fourteenth SCTB: Conservation, Recruitment, FADS and MSY

John Sibert

The Standing Committee on Tuna and Billfish (SCTB) gathered in Noumea, New Caledonia August 9–16, 2001, at a meeting marked by several "firsts:"

- it was the first time no scientists from Japan were present;
- it was the first time a scientist from the Peoples Republic of China participated; and,
- it was the first time the SCTB made a conservation recommendation.

Notable News: Japanese scientists boycotted the 2001 SCTB meeting, while a scientist from the People's Republic of China participated for the first time. Also, the SCTB reconsidered the suitability of MSY as a stock management tool, and made its first-ever conservation recommendation: freeze fishing mortality on juvenile fish until uncertainty about certain assessments is resolved.

Who Came (and Who Didn't)

SCTB14 was attended by scientists from Australia, the Federated States of Micronesia, Fiji, France, French Polynesia, Guam, Kiribati, Korea, New Caledonia, New Zealand, Papua New Guinea, the Peoples Republic of China, Samoa, the Solomon Islands, Taiwan, the United States, and Vanuatu. Also in attendance were representatives from the United Nations Food and Agriculture Organization (FAO), the Inter–American Tropical Tuna Commission (IATTC), the Secretariat of the Pacific Community (SPC, host of SCTB14), and the Forum Fisheries Agency (FFA).

For the first time in the history of the SCTB, Japanese scientists did not participate. The Fisheries Agency of Japan cited its objection to the newly created Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPO) as the reason why Japanese scientists were prevented from attending; the convention is known more commonly as the MHLC convention.

Recent Developments in the Fishery

Papers presented at SCTB14 can be obtained in electronic form from the SPC Oceanic Fisheries Programme web site: http://www.spc.int/oceanfish/.

During 2000, the estimated total catch of the four main tuna species was more than 1.8 million metric tons (mmt), only slightly less than the highest annual catch on record: 1.9 mmt in 1998. The 2000 WCPO catch of skipjack (1.2 mmt) was slightly higher than in 1999, but below the 1998 record catch of 1.3 mmt; also, skipjack as usual dominated the total catch (63%). The 2000 yellowfin catch was 420,000 mt, slightly less than in 1999, while the 2000 South Pacific albacore catch was 43,000 mt, slightly higher than in 1999. Most notably, the 2000 bigeye catch was a record high 115,000 mt, eclipsing the previous record of 109,000 mt set in 1999.

The purse seine fleet produces 60% of the total tuna catch in the WCPO. The majority of the purse seine catch is produced by the distant-water fishing nations (DWFNs) of Japan, Korea, Taiwan and the U.S., but there is a growing proportion produced by developing fleets in the coastal states and territories of the region. The large catches by the purse seine fleet came during a period when prices paid by canneries approached a record low of approximately US$400/mt. In reaction to the low prices, purse seine activity declined slightly through most of 2000, yet favorable oceanographic conditions and a rapid increase in use of drifting fish aggregating devices (FADs) resulted in high production in spite of declining effort.

Longline fishing is on the increase in the WCPO. The total longline catch of tuna in 2000 was the highest on record, just exceeding the 1980 catch. A major component of this increase is longline fisheries targeting albacore; South Pacific albacore comprised 37% of the total 2000 longline tuna catch. Substantial increases in longline swordfish catches were also reported by some countries. The number of domestically based longline vessels in WCPO countries is steadily increasing, and further increases in longline activity for both domestic and DWFNs are envisaged in the next two years. Some of these are expected to target premium sashimi-quality tunas, while others will target albacore or swordfish.

Species-Specific Assessments

Evaluation of the condition of the major tuna stocks in the WCPO— skipjack, yellowfin, bigeye and southern albacore— is one of the primary activities of SCTB. Well-developed stock assessments are available for yellowfin and southern albacore, with preliminary assessments for bigeye and skipjack.

There is no indication that the fishery is having an adverse impact on the skipjack stock even though skipjack catches are very large. Recruitment[1] continues to be high, and the total biomass of skipjack appears to be on the increase.

Yellowfin biomass has dropped steadily since 1997 but remains above the historical lows of the early 1970s. Increased use of drifting FADs has elevated fishing mortality by purse seine fleets on juvenile yellowfin. The declines in biomass are most notable in equatorial subregions that form the heart of the purse seine fishing grounds. Recruitment has been low in the central and eastern subregions as well. Several participants at the meeting expressed the opinion that the fishery is beginning to adversely impact the yellowfin stock in some areas.

Southern albacore stocks in the WCPO appear to be in good condition. Biomass is high, recruitment has been at near-record

[1] Recruitment refers to the rate at which young fish enter the exploitable population. It is a function of reproductive rate and the survival of larvae and pre-recruit stages.

highs for the last 3 years, and the fishery appears to have had little impact on the stock over the last 40 years.

Two different stock assessments were presented for bigeye—one Pacific-wide assessment using MULTIFAN-CL[2], and an assessment restricted to the WCPO using the A-SCALA method under development at the IATTC. The two methods share a number of important features, but produced somewhat different results. These differences are attributable to spatial structure, use of tagging data, and whether or not the models used assumed values of natural mortality or estimated natural mortality in the integrated analysis. When the two models use the same structural assumptions and data, they produce nearly identical results. The results of the Pacific-wide analysis show a long-term decrease in bigeye recruitment and biomass since the 1960s. The widespread use of drifting FADs, both in the Western and Eastern Pacific, has also increased fishing mortality by purse seine fleets on juvenile bigeye. SCTB has established a Methods Research Group to compare and evaluate different stock assessment methods.

The Role of Recruitment and MSY Theory

The results of these four assessments yield an important general conclusion. Recruitment for all four species appears to have been highly variable over the past 40 years and to be related to oceanographic conditions, particularly the El Niño Southern Oscillation (ENSO) cycle. However, different species seem to respond to oceanographic changes in different ways; some species have higher recruitment during El Niño periods, while others have lower recruitment. Further, these species grow rapidly, so trends in biomass and fishery production often reflect changes in recruitment. Plans to research the relationship between oceanographic conditions, fish production and fishery performance were discussed at SCTB14.

Stock assessments of blue shark and blue marlin were presented in the context of the Billfish and Bycatch Research Group. The population of blue sharks in the North Pacific appears either to be stable or growing, and the current catch is well below levels that would be damaging to the population. The blue marlin assessment is still in development, but the preliminary conclusion is that the stock is fully exploited, a conclusion consistent with previous assessments presented in other fora.

Stock assessment results presented at SCTB14 provoked lengthy discussions about the suitability of maximum sustainable yield (MSY) as a biological reference point for the management of tuna fisheries. Several assessments attempted to estimate MSY, but concluded that it is nearly impossible to estimate accurately, depending more on model assumptions than on data. In some examples, MSY was so ill determined that current catches could be either 50% below or 50% above MSY. Environmentally mediated variability in recruitment, close coupling of biomass and fishery yield to recruitment, and statistical uncertainties in estimation led some SCTB participants to conclude that reliance on MSY is problematic at best and probably misguided.

SCTB Urges Restraint

The SCTB generally makes a number of recommendations about research to be conducted by SCTB participants, but this year's meeting expanded the scope of that traditional function by proffering the following conservation recommendation:

"Recognizing the continuing concern of the SCTB about the status of yellowfin and bigeye tuna stocks in the WCPO, and recognizing the increasing catchability of juveniles of these species in surface fisheries, particularly those using FADs, SCTB 14 recommends that there be no increase in fishing mortality in surface fisheries on these species in the WCPO until uncertainty in the current assessments has been resolved."

SCTB recommends no increase in mortality of juvenile yellowfin and bigeye because of concern about increased exploitation through use of drifting FADs— but there is no institution yet to receive or implement this recommendation.

This recommendation is clearly a manifestation of concern over the increased exploitation of juvenile yellowfin and bigeye associated with the widespread use of drifting FADs in the purse seine fishery, especially during an episode of low recruitment. It is unclear, however, to whom this recommendation is directed and how it will be implemented. The Commission created by the MHLC Convention is not yet in place, so there is no international authority with competence to implement the recommendation. On several occasions the MHLC has sought the advice of the SCTB, but the SCTB has no official standing with the Commission.

SCTB14 also made the following recommendation regarding future research:

- [The SCTB] "... also strongly reinforces the value of large-scale tagging experiments to provide information on movement, natural mortality and exploitation rates. As this will reduce the uncertainty in existing assessments, SCTB recommends that funding be sought to undertake such work."
- The SPC has conducted two large-scale tuna-tagging experiments in the WCPO: the Skipjack Survey and Assessment Programme (SSAP) tagged fish from 1977 through 1982, while the Regional Tuna Tagging Programme (RTTP) tagged fish from 1989 through 1992. The SSAP provided a "snapshot" of the skipjack population prior to the expansion of the purse seine fishery. The RTTP provided a snapshot of both skipjack and yellowfin populations during the expansion. More than ten years have elapsed since the last experiment,

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[2] The development of MULTIFAN-CL and its application to yellowfin and bigeye were funded in part by grants from the PFRP to the SPC, and grew from an initiative at SCTB6 (Pohnpei) in 1993.

Fourteenth SCTB (continued from page 3)

and the fishery has more or less stabilized at current levels. It is past time for a third regional tagging experiment.

SCTB Background

The SCTB was established in 1988 to provide a forum in which scientists and others interested in tuna stocks of the Western and Central Pacific Ocean could meet to discuss changes in the fisheries, as well as scientific issues related to data, research and stock assessment. SCTB tries to be nonpolitical, and usually succeeds— people participate as individuals rather than as representatives of their governments and agencies. Participation is particularly encouraged among scientists from coastal states and territories, scientists from countries whose vessels fish in the region, and scientists from international tuna fisheries management organizations. Scientists from all coastal states and territories in the region, and from Indonesia, Japan, Korea, the Philippines, Taiwan and the United States, have participated in previous meetings. Scientists affiliated with the PFRP have taken part since 1993.

Japanese Contribution Missed

The absence of scientists from Japan was acutely felt. The current chair of the Bigeye Research Group is from Japan, and Japanese scientists normally make substantial contributions to the work of several research groups. The deliberations of the SCTB were diminished by their absence. On the other hand, participation by a scientist from the Shanghai Fisheries University was a most welcome increase in the scope of SCTB membership. The Chinese operate longliners in the Atlantic Ocean, and for the past several years, the number of Chinese longliners in the Pacific has been increasing. Inclusion of Chinese fishery statistics helps to improve the information base on which to base stock assessments.

This year's conservation and research recommendations demonstrate that well-informed SCTB scientists are paying close attention to the condition of tuna populations in the WCPO, and that, if called upon, the SCTB is prepared to offer advice on management as well as research.

PFRP

John Sibert is Director of the Pelagic Fisheries Research Program at the University of Hawai'i School of Ocean and Earth Sciences & Technology.

December Gathering for PFRP PIs

The PFRP will convene its 2001 Principal Investigators Workshop on December 4– 6 at the University of Hawai'i Campus Center Ballroom, in Honolulu. The annual Workshop is generally organized around a specific theme, with a primary purpose of creating avenues of collaboration among scientists from different disciplines. Previous Workshops, for example, have focused on Pacific tuna fisheries[1], genetic studies of population structure, economic considerations for international tuna management[2], and scales of spatial variability.

This year, the Workshop will have an additional function— to assist the PFRP in shaping a request for proposals for research in support of ecosystem-based management of pelagic fisheries. The PFRP has sponsored projects that address the biology and stock dynamics of target and incidental catch species, natural production systems that support the exploited populations, and revenue produced by the aggregate catch. Ecosystem-based resource management is rapidly becoming the preferred mode of fishery management, yet scientists and managers lack a clear operational understanding of how it works.

About half of the three-day workshop will be devoted to presentations of PFRP projects, and the remainder to discussion and presentations from invited speakers relating to ecosystem-based fishery management. What are the goals, appropriate policies and information requirements for an ecosystem-based resource management regime for pelagic fisheries? To help the PFRP shape the 2001 request for proposals, these questions will be discussed at the workshop, prior to circulation of the RFP later in December.

Attendance will be limited to about 50 people. For details, please contact Dodie Lau (dlau@soest.hawaii.edu, (808) 956-7895) or John Sibert (jsibert@soest.hawaii.edu), or consult the PFRP Web Site (http://www.soest.hawaii.edu/PFRP).

PFRP

[1] Sibert, John, and Mary Nunn (eds.). 1996. Pacific pelagic fisheries: Current projects and related research. Abstracts of papers presented November 28-30, 1995. SOEST Publication 96-01, JIMAR Contribution 96-299, 49 pp.

[2] Chakravorty, Ujjayant and John Sibert (eds.). 1999. Ocean-scale management of pelagic fisheries: Economic and regulatory issues. (Proceedings of an international workshop organized by the Pelagic Fisheries Research Program, JIMAR, UH, November 12-13, 1997). SOEST Publication 99-01, JIMAR Contribution 99-321, 102 pp.

in either marine or terrestrial ecology; this highlights the importance of maintaining time series of population abundance over long periods, to detect and describe the principal sources of variability.

Synchronization in Long-Term Fluctuations

With records in hand, we proceeded to test whether there was any synchronization in long-term trends between series from the Western Mediterranean and near Atlantic. Simple visual scrutiny of the time series did indeed suggest synchronization between the long-term fluctuations in catches of different traps (Figure 2). To verify this, we compared pairs of different sites using a correlation coefficient (see Figure 3)— and the distributions of cross-correlations between long-term time series were clearly shifted to positive values of the correlation spectrum; this indicated the presence of similar long-term fluctuations in trap catches. We conducted other statistical analyses as well (see Ravier and Fromentin, in press), which led to the same conclusions: long-term trends in trap catches are synchronous all around the Western Mediterranean and near Atlantic coasts, whereas short-term variability appears only on a local scale.

Catch Fluctuations as Indicators of Abundance

As explained at the outset, traps are passive tools, only slightly modified over the centuries, that catch bluefin during their yearly spawning migrations. In this sense, a trap can be thought of as a sampling mechanism that each year catches the same proportion of the bluefin population. These facts and preliminary analyses (Sella, 1929; Fromentin et al., 2000), led us to suggest that long-term fluctuations in trap catches could reflect fluctuations in species abundance if they vary in the same way all around the Western Mediterranean and near Atlantic.

This suggestion led to development of a hypothesis in which long-term fluctuations in trap catches are a good proxy for fluctuations in population abundance. Indeed, if the traps did not catch a representative proportion of the bluefin population, there would have been no reason for the long-term fluctuations to appear synchronous throughout the Western Mediterranean and along the South coasts of Spain and Portugal.

Finally, a synthetic time-series was calculated to depict the general temporal pattern in abundance of Mediterranean bluefin; a filter was applied to this series to depict the long- and medium-term fluctuations. The trend of this series, which explained 78% of the total variance, can summarize the long-term fluctuations in Mediterranean bluefin abundance from 1634 to 1960: i.e., three 120-year cycles with peaks around 1635, 1760 and 1880, and troughs around 1710, 1820 and 1930, on which cycles of about 20 years are superimposed (see Figure 4).

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Upcoming Events

November 25–30, 2001

6th Asian Fisheries Forum: Asian Fisheries: Diversification and Integration
National Sun Yat-Sen University, Kaohsiung, Taiwan
Information: http://www.tfrin.gov.tw/AFS/2nd-announce/index.html
Contact: John Cooksey, Conference Manager / 2423 Fallbrook Place / Escondido, CA. 92027 / USA / Tel: 1-760-432-4270 / Fax: 1-760-432-4275 / E-mail: meeting-manager@aol.com

January 21-May 24, 2002

The 2002 SPC/Nelson Polytechnic Pacific Island Fisheries Officers Training Course

This course will be held at the School of Fishing, Nelson Polytechnic, in Nelson, New Zealand, from January 21 to May 24, 2002; this will be followed by a practical fishing course at a Pacific Island venue from May 27 to June 28, 2002.

The course is designed to provide selected Pacific Islanders with extensive practical training in a variety of fisheries skills and knowledge. Instruction is under the technical scrutiny of senior fisheries officials gathered at the Regional Technical Meeting on Fisheries.

The course fee for selected participants is payable to the Secretariat of the Pacific Community. Contact: Director General, Secretariat of the Pacific Community / B.P. D5 98848 Noumea Cedex, New Caledonia / Tel: (687) 26 20 00 / Fax: (687) 26 38 18 / E-mail: spc@spc.int.

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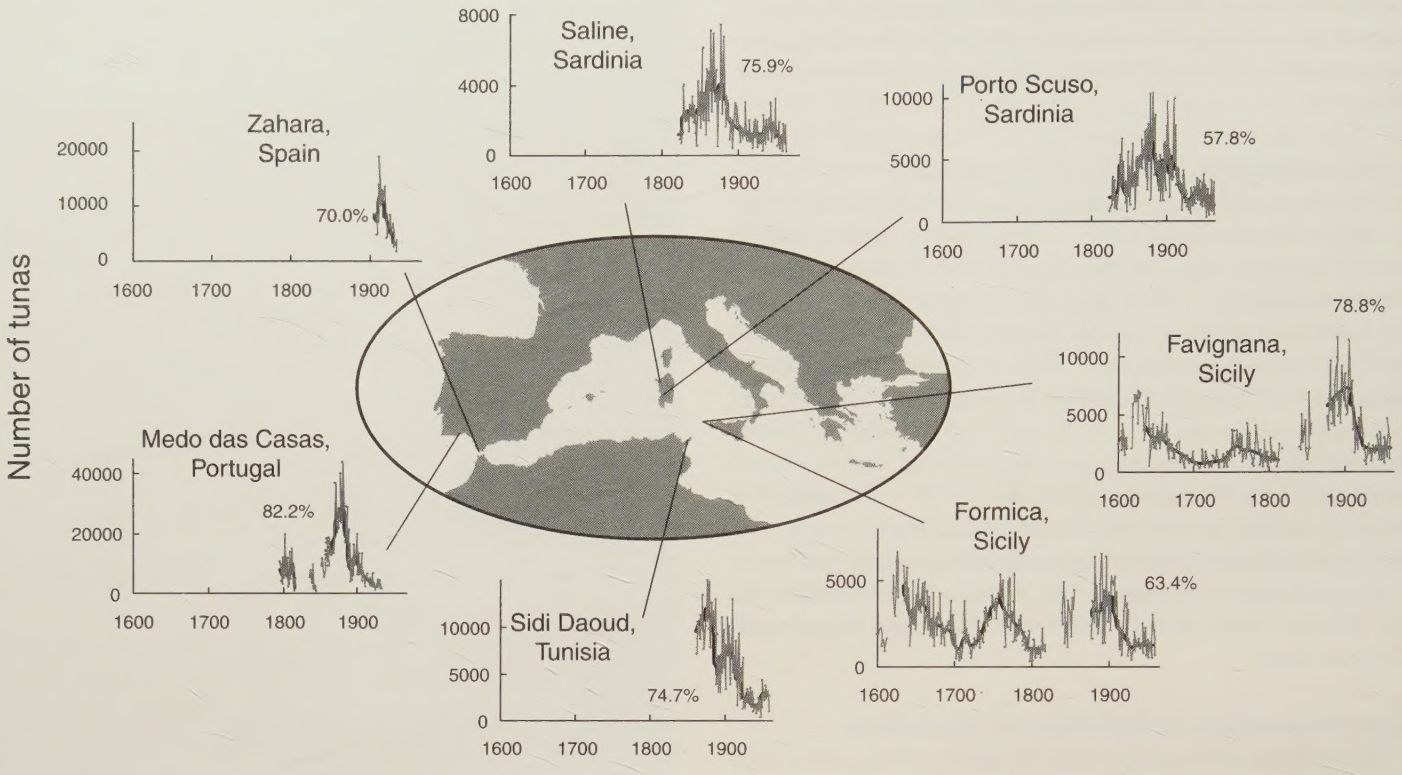

Figure 2. Time series of trap catches from the Western Mediterranean and near Atlantic (grey lines), smoothed by a filter (black line). The percentages shown are of variance explained by the trend.

Management Implications

The International Commission for the Conservation of Atlantic Tunas (ICCAT) convention uses maximum sustainable yield as a reference point for tuna management. The search for a unique and absolute reference point with which to manage a stock implicitly supposes that the stock's population is at equilibrium or steady state. However, our results show that long-term variations in population abundance are important, so the concept of MSY would be irrelevant for species populations with complex dynamics, such as bluefin in the Northeast Atlantic and Mediterranean. It appears critical then, to define a suitable precautionary approach that will take into account the natural temporal variability of this stock, by determining, for example, a level of reference that is time dependent, rather than a simple reference point.

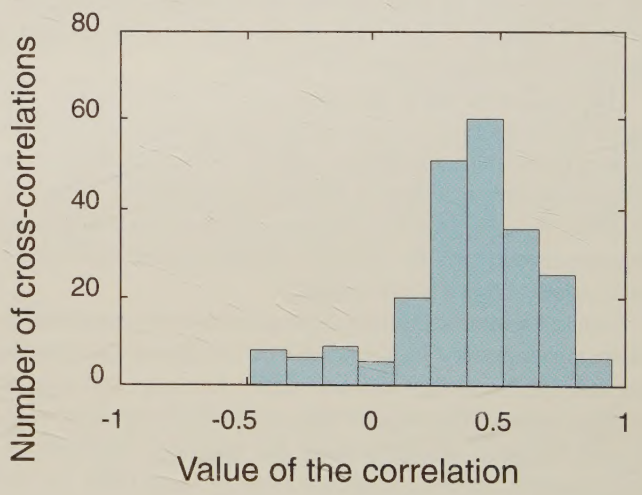

Figure 3. Distribution of correlation coefficients between long-term time-series series (those that overlapped over more than 50 years).

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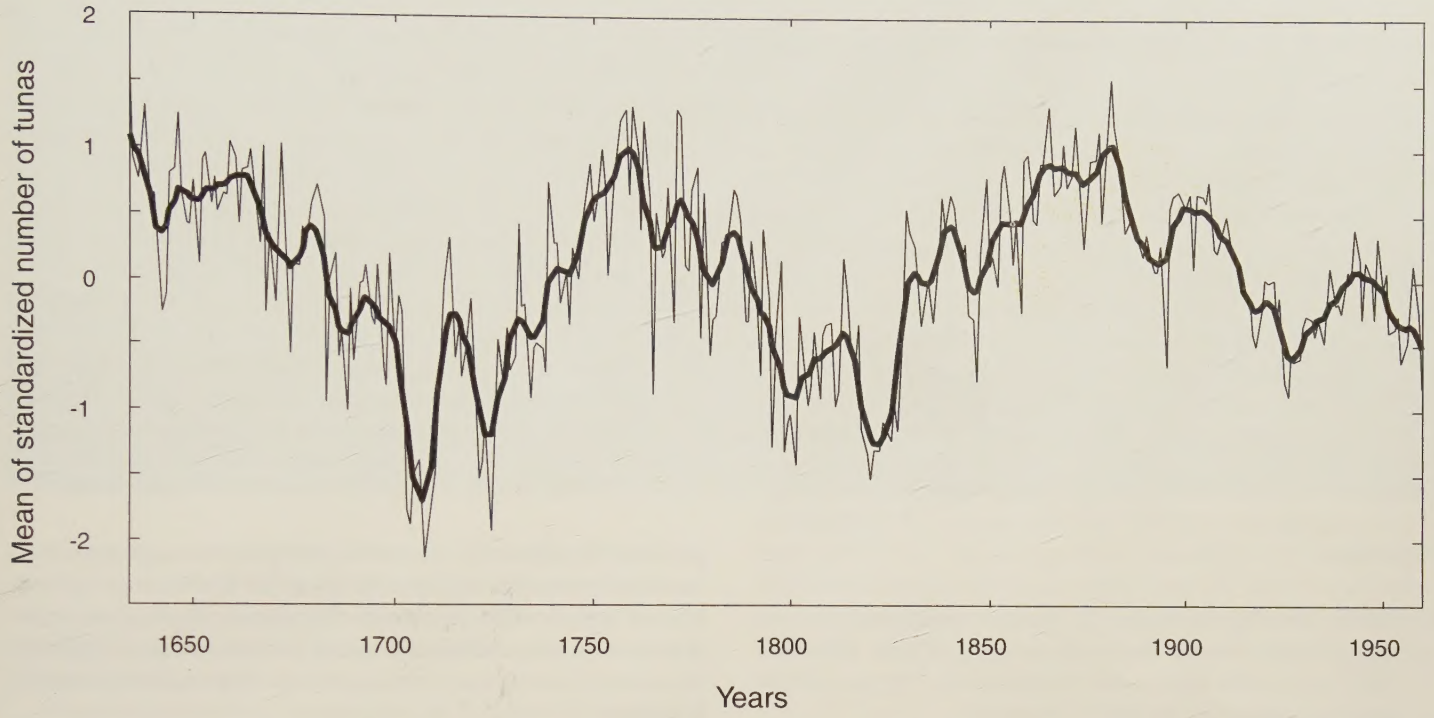

Figure 4. Synthetic series computed from the data set of trap-catches' time series (thin line). The trend (thick line) constitutes an index of long-term fluctuations in abundance.

Ravier, C., and Fromentin, J.-M. in press. Long-term fluctuations in the Eastern Atlantic and Mediterranean bluefin tuna population. ICES Journal of Marine Science.

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PFRP

A contemporary account of the use of fish traps in Sicily, Italy, can be found in "Mattanza: Love and Death in the Sea of Sicily" by author Theresa Maggio (Perseus Books, $25, ISBN 073820269X). Passages in the book describe the 1986 mattanza, or springtime harvest of giant Atlantic bluefin, from a "chamber of death" in a Sicilian tuna trap. For more information and photos, see a review of the book at http://www.bookpage.com/0005bp/nonfiction/mattanza.html, or visit the author's website at http://www.theresamaggio.com/.

MHLC7— Evaluation & Comments

Following is the third in a series of commentaries on the Multilateral High-level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific, which concluded with the Convention and Final Act adopted September 2, 2000 in Honolulu.

The goal of this series is to share the evaluations of scientists and other interested persons who are well informed about the MHLC, in the hope that continued frank discussion can contribute to the most effective and mutually agreeable implementation of the Convention. We have accepted the assessments of persons recommended as knowledgeable about MHLC7, and are seeking additional comment. Our principal criteria are that contributors are familiar with the proceedings, the science and the proposed management schemes, and are willing to answer the same questions, with an opportunity for open comment.

Biographical information about contributors is held till after the assessment; it is hoped this will encourage readers to consider each assessment on its merits, rather than on the basis of who provided it. Comments, questions, and requests for inclusion as a contributor may be addressed to Editor, PFRP News / MSB 313 / 1000 Pope Road / Honolulu, Hawai'i 96822, or e-mailed to andercox@aol.com.

Peter Ward

1. *MHLC meetings attempted to resolve international concerns and develop a formal means of managing "Highly Migratory Fish Stocks in the Western and Central Pacific." Do you feel this goal was achieved by the MHLC meetings?*

MHLC was an early step in the development of science arrangements that eventually will provide the Western and Central Pacific Tuna Commission with technical advice that is objective and of high quality. The MHLC Convention defines the structures and processes for reaching those goals; it is now up to participants of the Preparatory Conference and, eventually, the Commission, to "breath life" into the Convention text.

The success of the Commission in meeting its objectives will ultimately depend on participants. High levels of cooperation and contribution, mutual respect and trust are essential ingredients in regional scientific and management organisations.

2. *Do you feel MHLC7 was a good conclusion to these meetings?*

Some may have been disappointed that no firm arrangements were specified regarding provision of interim scientific advice in the Consultation's Resolution. Others may have wanted agreement on a firm base for funding of scientific work, both in the interim and in the long term. However, it is not always possible for such a large and occasionally unwieldy forum to resolve such complex issues. The Preparatory Conferences now present an opportunity to resolve outstanding issues at a practical level.

Overall, I believe that the extensive series of MHLCs provided a unique opportunity to discuss critical facets of UNIA and its operation through the Convention. The Convention provides a dual structure involving a committee of national scientists and other experts and specialist institutions, like the Secretariat of the Pacific Community (SPC), under contract to undertake specific projects. The scientific committee sets priorities and provides a commentary on the advice provided to the Commission by contracted experts. MHLC7 provided significant clarification of the science structure, and open discussion of the merits of pathways for communicating and reviewing the advice provided by scientific experts.

3. *Should there be an MHLC8, and if so, what should be addressed at that meeting?*

Regarding the science arrangements, our Convention now represents significant compromise by many, if not all, participants. All participants had ample opportunity to provide input on those issues. Fishing continued during the 1994–2000 negotiations, and it continues now. The fish and most fishers are not aware of the negotiations. Stock problems, such as the affects of purse seining on bigeye tuna, are emerging and appropriate programs to deal with new and emerging issues need to be initiated now.

4. *In terms of research and data gathering, what advantages do you feel the MHLC Convention has over other Conventions dealing with highly migratory fish stocks?*

Organizations, particularly SPC, have fostered a long history of high-quality, cooperative scientific research in the region. This includes the compilation of extensive fisheries data sets and groundbreaking research programs, such as tag-recapture studies. Along with that history come important links and networks among scientists in the region.

The Convention's dual structure will provide the Commission with flexibility in obtaining scientific advice. It can utilize in a highly cost-effective manner the expertise of many scientific institutions in the region and worldwide. It also can utilize the collective experience and skills of national scientists in reviewing research and assessments, and in setting priorities.

5. *What are the disadvantages of the MHLC Convention with regard to data collection and research?*

The MHLC Convention has the best of both worlds regarding flexibility in how the Commission obtains scientific advice. Compared with other regional conventions, I can't honestly imagine the MHLC Convention suffers from any disadvantages regarding data collection. The MHLC Convention specifies exactly what sorts of data must be submitted, timeliness, verification and who is responsible for submitting the data. It is especially reassuring to see that it recognizes the importance of deploying observers to verify data and to collect additional information on fishing practices, gear, and interactions with non-target species.

6. *What do you consider to be the major obstacles facing the scientific arrangements associated with the Commission?*

Assessing the impacts of fishing on non-target species and developing an ecosystem-based approach loom as major technical obstacles. The open ocean is extremely difficult to study at the systems level, and we just don't have the basic biological data or catch statistics for many of the species.

From an institutional perspective, we will have to work hard to ensure that the scientific arrangements— the scientific committee and contracted experts— are insulated from politics. We need to be confident that their advice is technically sound and objective.

7. *What do you consider to be the major obstacles facing the MHLC Commission over the next few years?*

The issue of national allocation of total allowable catch (TAC) looms as a major hurdle. Some participants may think that management of the fisheries will involve scientists simply providing species-specific TACs— single, constant amounts of each of the four key tuna species that can be harvested— after which protracted negotiations would commence on how the TACs are to be divided among the various contracting parties.

In reality, the management of Western Pacific tuna fisheries is unlikely to be based on a single TAC. Potential levels of fishing effort are unlikely to threaten several target species, such as skipjack. Consequently, economic questions come into play, and concern over the effects of fishing on non-target species might actually drive fishery management.

If at all possible, we must avoid a long and unproductive debate over national allocations. The first step is to agree on precautionary TACs and how they are to be monitored and enforced.

In the short to medium term, we will need to promote equitable participation in Commission activities and sharing of the financial burden of the Commission's work. An inadequate budget will severely limit the extent and quality of the Commission's scientific work. In particular, I am worried about the prospect of a reduction in scientific work when aid donors begin to cease subsidizing work that should rightly be funded by those who benefit from the resource. I do not want to be involved in a process that, in hindsight, proves to have resulted in a deterioration of our information base and scientific work.

8. *In the wake of MHLC7, how will management of high-seas fisheries in the Western Pacific change over the next ten years?*

Slowly! Unless we are faced with a major catastrophe that requires region-wide collaboration, I believe that management of the Western Pacific tuna fishery will be slow to change from the current unilateral and sub-regional approaches. These approaches have developed over many years and may seem at present to work adequately.

When the Western and Central Pacific Tuna Commission becomes active, we will begin to see implementation of regional standards for the routine activities of fishery management, such as data provision, reporting, and boarding and inspection. Unfortunately, management measures will be slow to implement in the absence of a major stock problem or compelling scientific advice, or until adverse market effects arise from public perceptions.

9. *As far as scientific research is concerned, what needs to be done during the approximately 3 years of Preparatory Conferences that take place between adoption of the text and enactment of the Convention?*

It is really up to participants to discuss and agree on research priorities. Any work will depend upon availability of appropriate funding, and agreement on the areas in which to spend those funds. Therefore, the Preparatory Conferences need to develop budgets, and participants need to seriously consider their financial commitments over both the interim and long-term.

We would be remiss if, when a stock problem arises, scientists are not ready to provide the Commission with firm scientific advice. We therefore must begin to set up the structures specified by the Convention, and expand data collection, research and assessment.

The first Preparatory Conference has already decided to approach existing organizations, such as the SPC and the Standing Committee on Tuna and Billfish, for interim scientific advice. It might also be useful to engage an organization to work on a high-priority project, such as the impacts of FAD fishing on bigeye. Such a project would provide timely and useful advice, and allow the Preparatory Conference to test how the structures will work and what will be required to support them. By "support," I mean secretarial support, as well as arrangements for tendering and managing contracts, and reporting and reviewing project outputs.

(continued on page 10)

10. How will Northern Subcommittee interests be accommodated in MHLC scientific arrangements?

The Northern Subcommittee's interests need to be identified by contracting parties with an interest in the stocks that are found mostly in the northern area. Presumably, meetings of the Commission's scientific committee will be organized into specialist groups, similar to the current SCTB, with sequential or concurrent meetings held to discuss data, particular species and other issues. There might be a group dealing with northern species, or separate groups on, say, northern bluefin and North Pacific albacore. There also might be merit in combining some groups, such as North Pacific albacore and South Pacific albacore.

Other interests of the Northern Subcommittee, such as bycatch and data and statistics, might best be integrated with the scientific committee's broader activities. The Northern Subcommittee would need to propose how funding can be obtained to support its activities and any specific research projects that are required.

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Peter Ward was scientific advisor to Australia's delegation during the MHLC negotiations, and chaired the first meeting of the Scientific Working Group at the Preparatory Conference in April. He has worked for the SPC and coordinated the SCTB's Billfish and Bycatch Research Group. He is currently at Dalhousie University in Canada, studying longline bycatch. Upon completion of these studies, Ward will return to a position with the Australian Bureau of Rural Sciences, where he is responsible for providing scientific advice for management of pelagic fisheries. The comments presented here are his own views and not necessarily those of the Australian Government or Dalhousie University.

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